

908 Pediatric Cardiology: Treatment of Coarctation of the Aort.

Wednesday, April 1, 1998, 4:00 p.m.-5:00 p.m.
Georgia World Congress Center, Room 365W

4:00

908-1 Changes in Protein Distribution of the Aortic Wall Following Balloon Aortoplasty for Coarctation

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Background: The long-term consequences of balloon aortoplasty for native coarctation are unknown. The matrix proteins elastin, collagen, and glycosaminoglycans (GAG), likely influence the mechanical properties of the aortic wall, and changes in these proteins induced by balloon dilatation may affect aortic wall structure.

Methods: From 1993 through 1997, 52 patients underwent excision of their aortic coarctations with extended end-to-end repairs. Of these, 42 patients had no previous interventions, and 10 had undergone balloon dilatation. The operative specimens were evaluated using a modified Movat's hematoxylin stain for elastin, alcian blue for collagen, and alanine blue for GAG. Each specimen was subjected to a computerized digitally applied planimetric analysis. The percentage contribution of each matrix protein to each layer of the wall (intima, media, and adventitia) was calculated and expressed as a mean value \pm 1 SD. Results were analyzed with ANOVA and Bonferroni's inequality for multiple comparisons.

Results:

Median protein distribution

	%Elastin	%Collagen	%GAG
Balloon	39.8 \pm 24.7	15.9 \pm 7.3	11.9 \pm 9.6
No Balloon	22.3 \pm 9.0	30.0 \pm 15.8	9.9 \pm 6.3
p value	0.0005	0.009	0.43

Differences in protein distribution in the intima and adventitia were minimal. In the media, however, the Balloon group demonstrated a significantly lower collagen density and higher elastin density than the No Balloon group.

Conclusions: Balloon aortic dilatation for coarctation alters aortic wall protein distribution. This has implications for the long-term fate of aortic wall structure and may influence late pathologic changes.

4:15

908-2 Aortic Elastic Properties in Patients With Repaired Coarctation of Aorta

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Background: The surgical intervention for coarctation of the aorta (CoA) aims at normalizing the blood pressure. However in patients (pts) with successfully repaired CoA (RCoA) the incidence of hypertension is as high as thirty percent. Although the elastic properties of the aorta have been studied in several conditions such studies have not yet been performed in pts with RCoA. The aim of this study was the comparison of the elastic properties of the aorta at the aortic arch (preCoA) site and at the distal thoracic aorta (postCoA) site in pts with RCoA and in controls.

Methods: Twenty pts (36 \pm 16 years old) with RCoA, (14.3 \pm 4.9 years) after surgery, non hypertensive and with residual gradient at the site of CoA $<$ 25 mmHg and 20 age-matched healthy controls underwent transesophageal echocardiogram (TEE). The systolic and diastolic cross-sectional area as well as the fractional area change (FAC) were obtained at the pre and post CoA sites by acoustic quantification. Non-invasive blood pressure measurements at the right up and down limb were performed simultaneously. The distensibility (in $\text{cm}^2 \text{dyn}^{-1} 10^{-6}$) of aorta was calculated using the formula: $\text{Distensibility} = 2 \times (d_{\text{max}} - d_{\text{min}}) / (d_{\text{min}} \times \text{pulse pressure})$, where $d = 2 \times \sqrt{\text{area} / 3.14}$.

Results:

	preRCoA	postRCoA	preControls	postControls
Pulse Pressure	58.3 \pm 13.2	37.6 \pm 11.7	38.0 \pm 14.8	34.2 \pm 13.9
FAC	8.0 \pm 3.0	19.9 \pm 4.9*	10.0 \pm 3.3	8.2 \pm 3.2
Distensibility	1.5 \pm 0.9	5.7 \pm 3.1*	2.2 \pm 0.7	1.7 \pm 0.5*

*p < 0.005: comparisons between pre and post sites.

A negative correlation between the age at surgery and the aortic distensibility of the preRCoA site in pts was found ($r = -0.75$, $p < 0.05$).

Conclusion: In controls the aortic distensibility decreases from the arch to the distal thoracic aorta while in pts with RCoA increases. CoA impairs the aortic elastic properties and surgery should be performed early, thus hypertension might be avoided.

4:30

908-3 Coarctation Repair in Infancy - Adverse Effects of Patch Angioplasty

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Between 8/91 and 12/96, 98 infants underwent coarctation repair at Children's Hospital of Wisconsin utilizing subclavian flap angioplasty (SCF) $n = 61$, end-to-end anastomosis (ETE) $n = 20$, or patch angioplasty (PA) $n = 17$. There were two early deaths in patients with LV hypoplasia/endocardial fibrosis and 10 late deaths in patients with complex heart disease and/or other congenital malformations. Eleven patients (11.6%) have required re-intervention for residual arch obstruction: 10 have had balloon angioplasty (BA) and one surgical angioplasty. The incidence of recoarctation following PA was significantly higher than with SCF (5/17 = 29% vs 4/61 = 6.6%, $p = 0.034$); 2/20 patients (10%) had recoarctation following ETE (NS compared to other techniques). Preoperative echo was reviewed in 89 patients and revealed no significant differences in aortic arch dimensions when compared between surgical groups. Angiography at the time of re-intervention showed isolated, discrete distal obstruction in 4/4 patients following SCF. Three of five patients following PA had additional or isolated proximal transverse arch narrowing and 1/2 patients following ETE had long segment transverse arch hypoplasia. In addition, one patient with PA died suddenly following BA 2nd to arch disruption at the patch site. We conclude that PA carries a significantly higher risk of recoarctation when compared to SCF and can complicate later arch interventions. We feel that SCF is the procedure of choice for infantile coarctation with the lowest recoarctation rate and least arch distortion at follow up.

4:45

908-4 Balloon Dilatation of Native Coarctation of the Aorta in Children: Influence of Stretch, Gain and Recoil on Outcomes

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Background: As balloon dilatation of native aortic coarctation (CoA) remains controversial, we sought to determine if the biophysical properties of the dilated CoA segment affect outcomes.

Methods: From 6/88 to 12/96, 69 patients had percutaneous transcatheter dilatation of CoA, at a median age of 5.8 yrs (range, 6 mo to 16.8 yrs). Hemodynamic data and angiographic dimensions were recorded, and follow-up data obtained. Stretch, recoil and gain of circumference and area of the CoA segment were calculated, and related to outcomes.

Results: Initial systolic gradients (mean \pm SD, 31 \pm 12 mmHg) were reduced by a mean of $-74 \pm 28\%$ ($p = 0.0001$), with increases in CoA diameter of $+145 \pm 139\%$ ($p = 0.0001$). Circumferential stretch was: $204 \pm 117\%$, recoil $26 \pm 13\%$ and gain $123 \pm 96\%$. One pt died related to a cardiomyopathy, and 6 pts had residual gradients > 20 mmHg. Nine patients required re-intervention (REINT) (6 surgery, 3 transcatheter) at a median interval of 8 mo (range, 1 mo to 7.6 yr) after the initial procedure. Freedom from REINT was 90% (95% CI, 82-98%) at 1 yr and 87% (78-96%) at 5 yrs with follow-up ranging to 8.5 yrs. Factors significantly associated with decreased time to REINT in bivariate hazard analysis included increased gradient before dilation, and increased circumferential and area stretch and gain, but not recoil at dilation.

Conclusion: Greater stretch and gain increase risk of REINT, perhaps related to altered elastic properties of the CoA and arch.